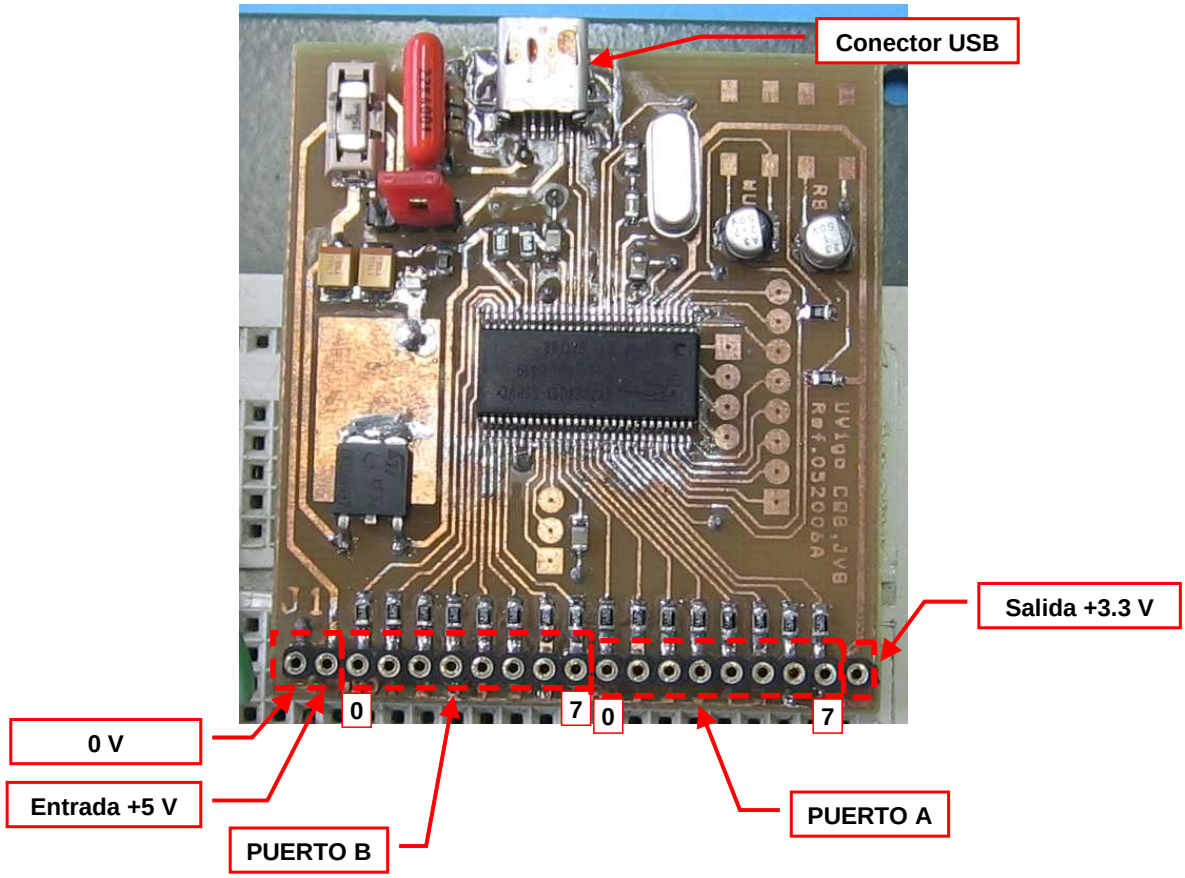
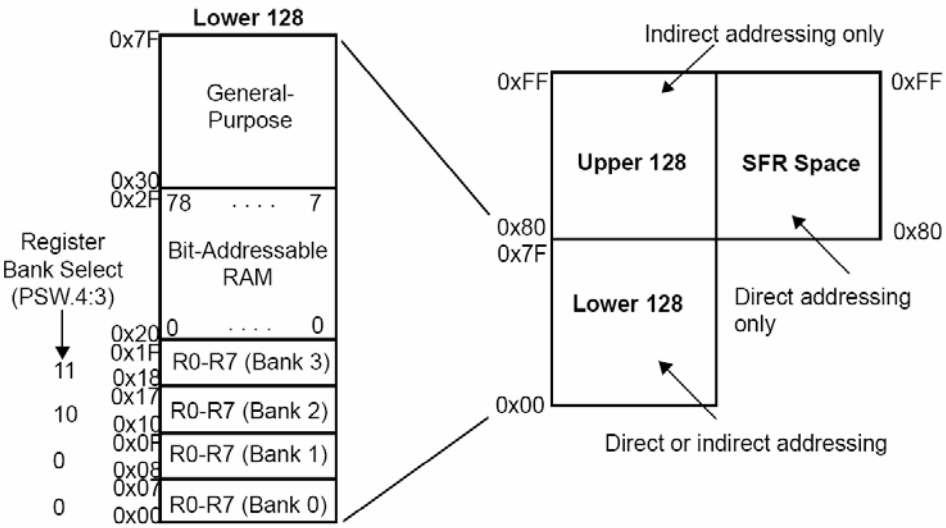
PLACA DEL MICROCONTROLADOR CY7C68013




MEMORIA INTERNA DE DATOS (256 bytes)



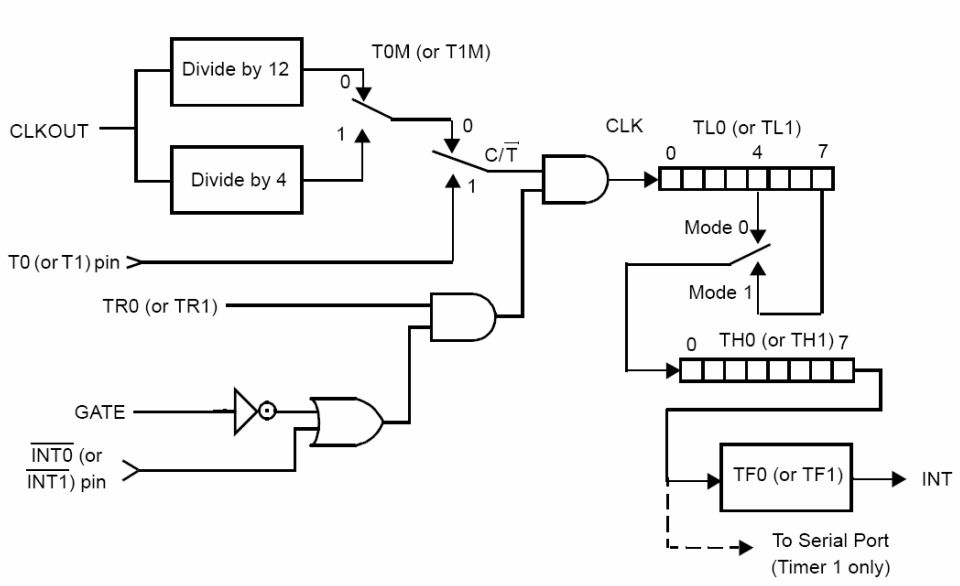

REGISTRO DE CONTROL DE LA CPU

**CPUCS** — **CPU Control and Status** — **E600**

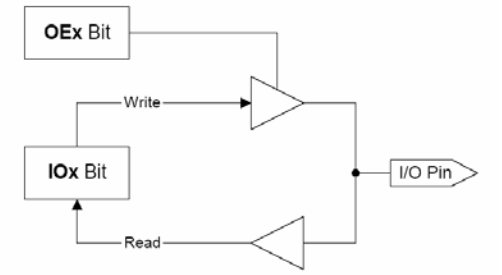
| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **PORTCSTB** | **CLKSPD1** | **CLKSPD0** | **CLKINV** | **CLKOE** | **0** |
| R | R | R/W | R/W | R/W | R/W | R/W | R |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

| CLKSPD1 | CLKSPD0 | CPU Clock |
|---|---|---|
| 0 | 0 | 12 MHz (Default) |
| 0 | 1 | 24 MHz |
| 1 | 0 | 48 MHz |
| 1 | 1 | Reserved |

TEMPORIZADORES 0/1 MODOS 0/1




CONFIGURACIÓN PUERTOS ENTRADA/SALIDA




**OEA** — Port A Output Enable — SFR 0xB2

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**OEB** — Port B Output Enable — SFR 0xB3

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**OED** — Port D Output Enable — SFR 0xB5

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**IOA** — Port A (Bit-Addressable) — SFR 0x80

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| x | x | x | x | x | x | x | x |

**IOB** — Port B (Bit-Addressable) — SFR 0x90

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| x | x | x | x | x | x | x | x |

**IOD** — Port D (Bit-Addressable) — SFR 0xB0

| b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |
| x | x | x | x | x | x | x | x |

REGISTRO TMOD (0x89)

| Bit | Function |
|---|---|
| TMOD.7 | **GATE1** - Timer 1 gate control. When GATE1 = 1, Timer 1 will clock only when $\overline{INT1}$ = 1 and TR1 (TCON.6) = 1. When GATE1 = 0, Timer 1 will clock only when TR1 = 1, regardless of the state of $\overline{INT1}$. |
| TMOD.6 | **C/$\overline{T}$1** - Counter/Timer select. When C/$\overline{T}$1 = 0, Timer 1 is clocked by CLKOUT/4 or CLKOUT/12, depending on the state of T1M (CKCON.4). When C/$\overline{T}$1 = 1, Timer 1 is clocked by high-to-low transitions on the T1 pin. |
| TMOD.5<br>TMOD.4 | **M1** - Timer 1 mode select bit 1.<br>**M0** - Timer 1 mode select bit 0.<br>M1 M0 Mode<br>0 0 Mode 0 : 13-bit counter<br>0 1 Mode 1 : 16-bit counter<br>1 0 Mode 2 : 8-bit counter with auto-reload<br>1 1 Mode 3 : Timer 1 stopped |
| TMOD.3 | **GATE0** - Timer 0 gate control, When GATE0 = 1, Timer 0 will clock only when $\overline{INT0}$ = 1 and TR0 (TCON.4) = 1. When GATE0 = 0, Timer 0 will clock only when TR0 = 1, regardless of the state of $\overline{INT0}$. |
| TMOD.2 | **C/$\overline{T}$0** - Counter/Timer select. When C/$\overline{T}$0 = 0, Timer 0 is clocked by CLKOUT/4 or CLKOUT/12, depending on the state of T0M (CKCON.3). When C/$\overline{T}$0 = 1, Timer 0 is clocked by high-to-low transitions on the T0 pin. |
| TMOD.1<br>TMOD.0 | **M1** - Timer 0 mode select bit 1.<br>**M0** - Timer 0 mode select bit 0.<br>M1 M0 Mode<br>0 0 Mode 0 : 13-bit counter<br>0 1 Mode 1 : 16-bit counter<br>1 0 Mode 2 : 8-bit counter with auto-reload<br>1 1 Mode 3 : Two 8-bit counters |

REGISTRO TCON (0x88)

| Bit | Function |
|---|---|
| TCON.7 | **TF1** - Timer 1 overflow flag. Set to 1 when the Timer 1 count overflows; automatically cleared when the FX2 vectors to the interrupt service routine. |
| TCON.6 | **TR1** - Timer 1 run control. 1 = Enable counting on Timer 1. |
| TCON.5 | **TF0** - Timer 0 overflow flag. Set to 1 when the Timer 0 count overflows; automatically cleared when the FX2 vectors to the interrupt service routine. |
| TCON.4 | **TR0** - Timer 0 run control. 1 = Enable counting on Timer 0. |
| TCON.3 | **IE1** - Interrupt 1 edge detect. If external interrupt 1 is configured to be edge-sensitive (IT1 = 1), IE1 is set when a negative edge is detected on the $\overline{INT1}$ pin and is automatically cleared when the FX2 vectors to the corresponding interrupt service routine. In this case, IE1 can also be cleared by software. If external interrupt 1 is configured to be level-sensitive (IT1 = 0), IE1 is set when the $\overline{INT1}$ pin is 0 and automatically cleared when the $\overline{INT1}$ pin is 1. In level-sensitive mode, software cannot write to IE1. |
| TCON.2 | **IT1** - Interrupt 1 type select. $\overline{INT1}$ is detected on falling edge when IT1 = 1; $\overline{INT1}$ is detected as a low level when IT1 = 0. |
| TCON.1 | **IE0** - Interrupt 0 edge detect. If external interrupt 0 is configured to be edge-sensitive (IT0 = 1), IE0 is set when a negative edge is detected on the $\overline{INT0}$ pin and is automatically cleared when the FX2 vectors to the corresponding interrupt service routine. In this case, IE0 can also be cleared by software. If external interrupt 0 is configured to be level-sensitive (IT0 = 0), IE0 is set when the $\overline{INT0}$ pin is 0 and automatically cleared when the $\overline{INT0}$ pin is 1. In level-sensitive mode, software cannot write to IE0. |
| TCON.0 | **IT0** - Interrupt 0 type select. $\overline{INT0}$ is detected on falling edge when IT0 = 1; $\overline{INT0}$ is detected as a low level when IT0 = 0. |

INTERRUPCIONES DEL FX2

| FX2 Interrupt | Source | Interrupt Vector | Natural Priority |
|---|---|---|---|
| IE0 | $\overline{\text{INT0}}$ Pin | 0x0003 | 1 |
| TF0 | Timer 0 Overflow | 0x000B | 2 |
| IE1 | $\overline{\text{INT1}}$ Pin | 0x0013 | 3 |
| TF1 | Timer 1 Overflow | 0x001B | 4 |
| RI_0 & TI_0 | USART0 Rx & Tx | 0x0023 | 5 |
| **TF2** | **Timer 2 Overflow** | 0x002B | 6 |
| **Resume** | **WAKEUP / WU2 Pin or USB Resume** | 0x0033 | 0 |
| **RI_1 & TI_1** | **USART1 Rx & Tx** | 0x003B | 7 |
| **USBINT** | **USB** | 0x0043 | 8 |
| **I²CINT** | **I²C-Compatible Bus** | 0x004B | 9 |
| **IE4** | **GPIF / FIFOs / $\overline{\text{INT4}}$ Pin** | 0x0053 | 10 |
| **IE5** | **INT5 Pin** | 0x005B | 11 |
| **IE6** | **INT6 Pin** | 0x0063 | 12 |

| Bit | Function |
|---|---|
| IE.7 | **EA** - Global interrupt enable. Controls masking of all interrupts except USB wakeup (resume). EA = 0 disables all interrupts except USB wakeup. When EA = 1, interrupts are enabled or masked by their individual enable bits. |
| IE.6 | **ES1** - Enable Serial Port 1 interrupt. ES1 = 0 disables Serial port 1 interrupts (TI_1 and RI_1). ES1 = 1 enables interrupts generated by the TI_1 or RI_1 flag. |
| IE.5 | **ET2** - Enable Timer 2 interrupt. ET2 = 0 disables Timer 2 interrupt (TF2). ET2=1 enables interrupts generated by the TF2 or EXF2 flag. |
| IE.4 | **ES0** - Enable Serial Port 0 interrupt. ES0 = 0 disables Serial Port 0 interrupts (TI_0 and RI_0). ES0=1 enables interrupts generated by the TI_0 or RI_0 flag. |
| IE.3 | **ET1** - Enable Timer 1 interrupt. ET1 = 0 disables Timer 1 interrupt (TF1). ET1=1 enables interrupts generated by the TF1 flag. |
| IE.2 | **EX1** - Enable external interrupt 1. EX1 = 0 disables external interrupt 1 (INT1). EX1=1 enables interrupts generated by the $\overline{\text{INT1}}$ pin. |
| IE.1 | **ET0** - Enable Timer 0 interrupt. ET0 = 0 disables Timer 0 interrupt (TF0). ET0=1 enables interrupts generated by the TF0 flag. |
| IE.0 | **EX0** - Enable external interrupt 0. EX0 = 0 disables external interrupt 0 (INT0). EX0=1 enables interrupts generated by the $\overline{\text{INT0}}$ pin. |

NOTAS SOBRE LA DOCUMENTACIÓN

-Una vez instalado el software de keil uvision2, en el directorio **C:\Keil\C51\HLP,** se encuentra el archivo **GS51.pdf** del manual de usuario. En este manual se debe estudiar principalmente el capítulo 4, que explica cómo crear un proyecto, y los capítulos 6 y 7, relativos a cómo usar el depurador.

-Por otro lado, en el directorio **C:\Cypress\USB\Doc\FX2**, se encuentra el archivo FX2 **TechRefManual.pdf** del manual del microcontrolador.

-Para programar el microcontrolador se utiliza el programa **EZ-USB Control Panel** con la opción FX2.

1.- Ejecutar el programa **Inicio/Todos los programas/Keil uVision2** y crear un nuevo proyecto con la opción **Proyect/Nex Projet**. Luego, en el fichero del programa, incluir en la cabecera del programa las siguientes directivas de compilación:

En el caso de que se programe en C:
```
#include "Fx2.h"
#include "Fx2regs.h"
```

En el caso de que se programe en ensamblador:
```
$NOMOD51    ; Inhibe registros del 8051 predefinidos
$INCLUDE (fx2regs.inc)
```

--Salvar el archivo del código fuente con extensión .c si se codifica en lenguaje C, y con extensión .A51 si se codifica en ensamblador.
--Fijarse si el módulo fuente (el archivo con el programa) está en la ventana del manejador de proyectos de uVision2, si no es así, añadirlo con la opción **Add Files to Group**.

2.- En la opción **Project/Select Device for Target 'Target 1'** seleccionar el dispositivo EZ-USB FX2 (Figura 1)

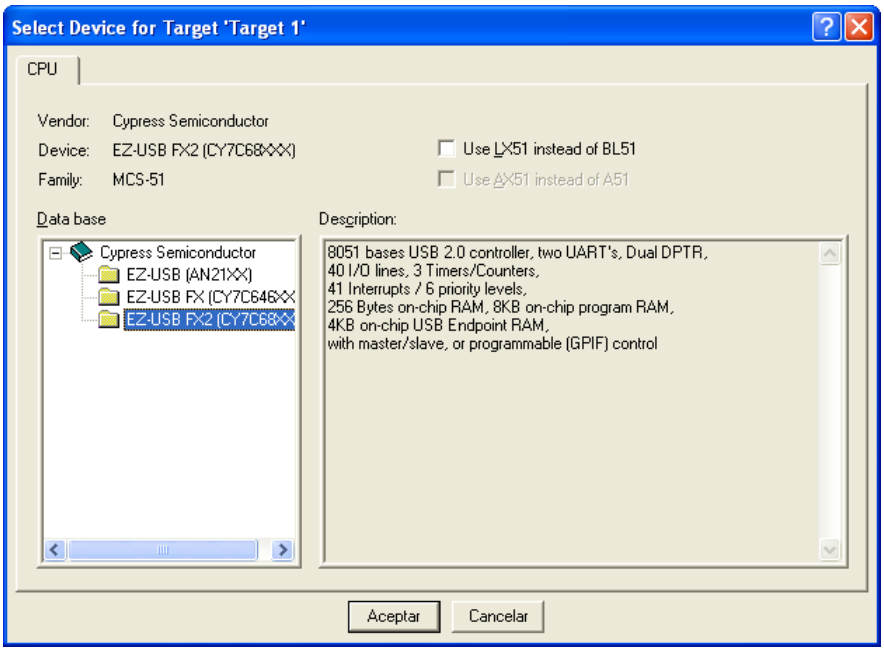


Figura 1

3.- En la opción **Project/Options for Target 'Target 1'/Target** configurar la frecuencia del reloj (Figura 2) y en la opción **Project/Options for Target 'Target 1'/Output** activar la orden de generar el fichero de salida **.hex**.

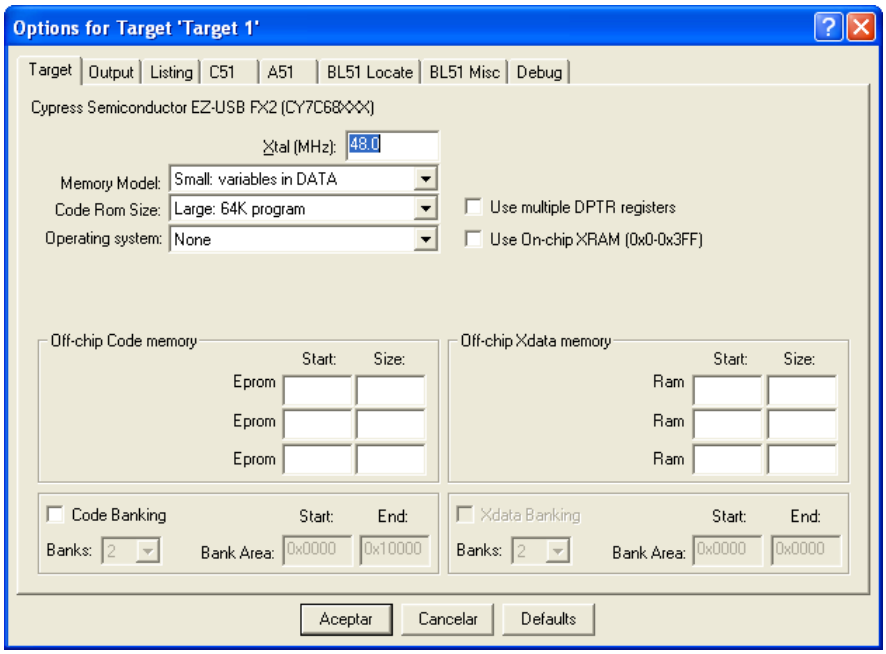


Figura 2

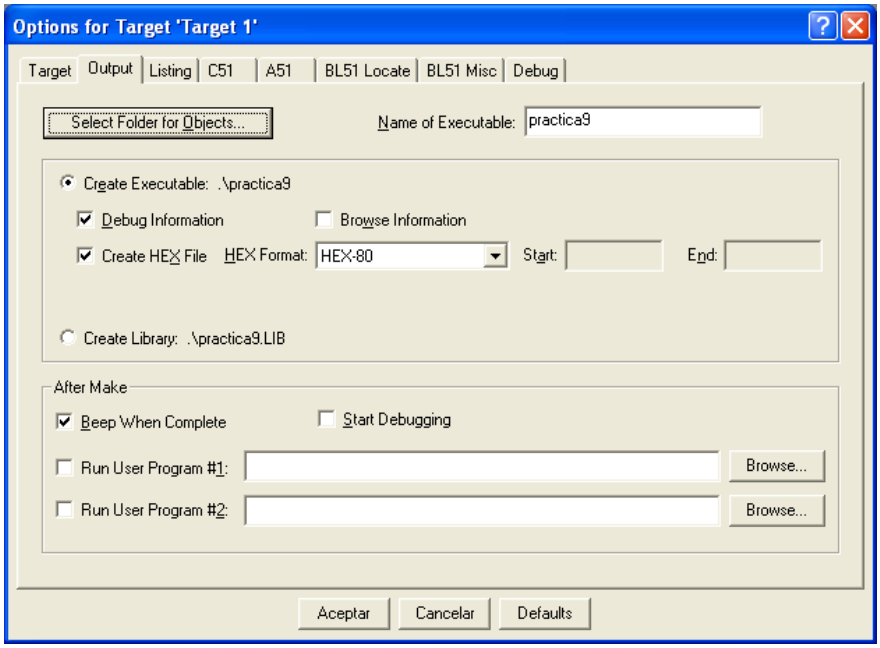



Figura 3

4.- En la opción **Project/File Extensions, Books and Enviroment/Enviroment setup** añadir la ruta de los archivos de las bibliotecas del dispositivo: **C:\Cypress\USB\Target\Inc** (Figura 4).

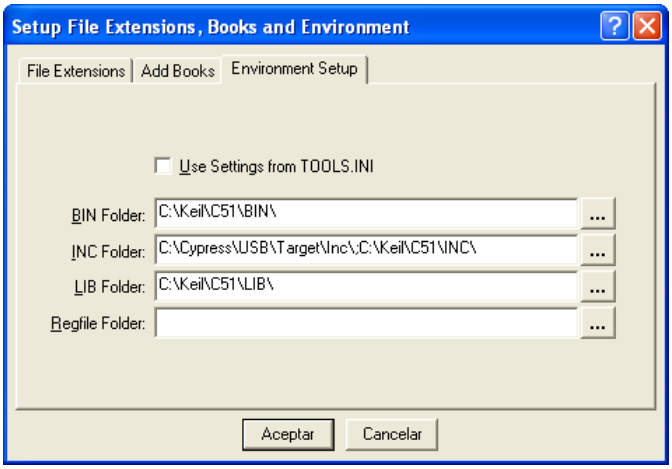



Figura 4

5.- conectar al puerto USB la placa del microcontrolador, ejecutar el programa **Inicio/Todos los programas/Cypress/EZ-USB Control Panel** y con la opción **Download** descargar el archivo .hex generado en el paso anterior (Figura 5).

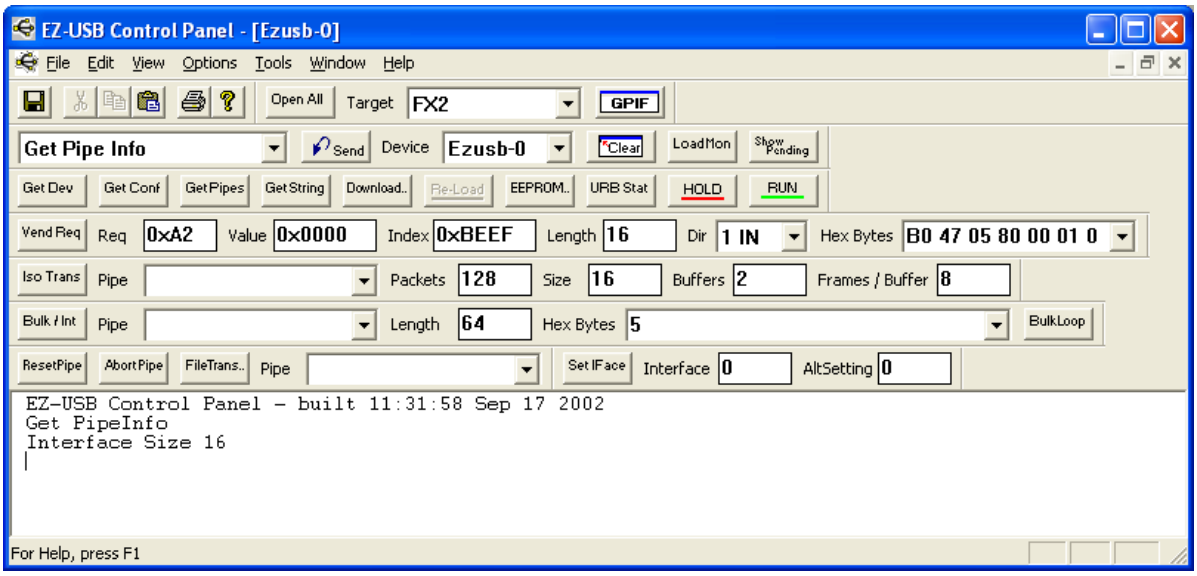



Figura 5